This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

---

1. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-9 - 10i)(-3 - 2i)$$

The solution is $7 + 48i$, which is option B.

A. $a \in [44, 52]$ and $b \in [-13, -7]$

$47 - 12i$, which corresponds to adding a minus sign in the first term.

B. $a \in [5, 13]$ and $b \in [45, 52]$

* $7 + 48i$, which is the correct option.

C. $a \in [44, 52]$ and $b \in [9, 16]$

$47 + 12i$, which corresponds to adding a minus sign in the second term.

D. $a \in [5, 13]$ and $b \in [-48, -41]$

$7 - 48i$, which corresponds to adding a minus sign in both terms.

E. $a \in [27, 35]$ and $b \in [14, 25]$

$27 + 20i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

---

2. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{12}{0}}$$

The solution is Not a Real number, which is option C.

A. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

B. Irrational

These cannot be written as a fraction of Integers.

C. Not a Real number

* This is the correct option!

D. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

E. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{\frac{12}{0}}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

---

3. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-7 - 4i)(6 - 3i)$$

The solution is $-54 - 3i$, which is option E.

A. $a \in [-44, -41]$ and $b \in [7, 16]$

$-42 + 12i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

B. $a \in [-32, -28]$ and $b \in [42, 49]$

$-30 + 45i$, which corresponds to adding a minus sign in the first term.

C. $a \in [-57, -52]$ and $b \in [3, 5]$

$-54 + 3i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-32, -28]$ and $b \in [-47, -40]$

$-30 - 45i$, which corresponds to adding a minus sign in the second term.

E. $a \in [-57, -52]$ and $b \in [-7, -2]$

* $-54 - 3i$, which is the correct option.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

---

4. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{36 + 33i}{6 - 8i}$$

The solution is $-0.48 + 4.86i$, which is option D.

A. $a \in [4.4, 5.3]$ and $b \in [-1.5, 0.5]$

$4.80 - 0.90i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-48.35, -47.25]$ and $b \in [4, 6.5]$

$-48.00 + 4.86i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [-0.9, 0.45]$ and $b \in [485.5, 486.5]$

$-0.48 + 486.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [-0.9, 0.45]$ and $b \in [4, 6.5]$

* $-0.48 + 4.86i$, which is the correct option.

E. $a \in [5.95, 6.45]$ and $b \in [-5, -3]$

$6.00 - 4.12i$, which corresponds to just dividing the first term by the first term and the second by the second.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

---

5. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-9 + 22i}{-3 + 4i}$$

The solution is $4.60 - 1.20i$, which is option A.

A. $a \in [3.5, 5]$ and $b \in [-2, -1]$

* $4.60 - 1.20i$, which is the correct option.

B. $a \in [3.5, 5]$ and $b \in [-30.5, -29]$

$4.60 - 30.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [114.5, 115.5]$ and $b \in [-2, -1]$

$115.00 - 1.20i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [2.5, 3.5]$ and $b \in [3.5, 6.5]$

$3.00 + 5.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [-3, -2]$ and $b \in [-5.5, -3.5]$

$-2.44 - 4.08i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

---

6. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{0}{49}} + \sqrt{4}i$$

The solution is Pure Imaginary, which is option A.

A. Pure Imaginary

* This is the correct option!

B. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

C. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

D. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

E. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

---

7. Simplify the expression below and choose the interval the simplification is contained within.

$$5 - 16^2 + 19 \div 4 * 11 \div 20$$

The solution is -248.387, which is option C.

A. $[262.9, 263.9]$

263.613, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

B. $[-255.4, -249.1]$

-250.978, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[-249.7, -247.8]$

* -248.387, this is the correct option

D. $[259.8, 261.5]$

261.022, which corresponds to two Order of Operations errors.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

---

8. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{1430}{10}}$$

The solution is Irrational, which is option C.

A. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

B. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

C. Irrational

* This is the correct option!

D. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

E. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{143}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

---

9. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{16}{16} + 81i^2$$

The solution is Rational, which is option A.

A. Rational

* This is the correct option!

B. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

C. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

D. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

E. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

---

10. Simplify the expression below and choose the interval the simplification is contained within.

$$2 - 10 \div 7 * 16 - (14 * 4)$$

The solution is -76.857, which is option B.

A. $[-57.09, -50.09]$

-54.089, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[-78.86, -75.86]$

* -76.857, which is the correct option.

C. $[49.91, 63.91]$

57.911, which corresponds to not distributing addition and subtraction correctly.

D. $[-139.43, -138.43]$

-139.429, which corresponds to not distributing a negative correctly.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

---

11. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(8 - 4i)(-3 + 2i)$$

The solution is $-16 + 28i$, which is option A.

A. $a \in [-18, -14]$ and $b \in [25, 37]$

* $-16 + 28i$, which is the correct option.

B. $a \in [-38, -31]$ and $b \in [-4, -2]$

$-32 - 4i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-38, -31]$ and $b \in [3, 5]$

$-32 + 4i$, which corresponds to adding a minus sign in the first term.

D. $a \in [-18, -14]$ and $b \in [-31, -23]$

$-16 - 28i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-26, -17]$ and $b \in [-9, -6]$

$-24 - 8i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

---

12. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{2145}{11}}$$

The solution is Irrational, which is option C.

A. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

B. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

C. Irrational

* This is the correct option!

D. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

E. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $\sqrt{195}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

---

13. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(5 - 4i)(-2 - 7i)$$

The solution is $-38 - 27i$, which is option E.

A. $a \in [-10, -5]$ and $b \in [27.12, 28.4]$

$-10 + 28i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

B. $a \in [17, 23]$ and $b \in [41.94, 43.43]$

$18 + 43i$, which corresponds to adding a minus sign in the second term.

C. $a \in [17, 23]$ and $b \in [-45.09, -41.71]$

$18 - 43i$, which corresponds to adding a minus sign in the first term.

D. $a \in [-40, -37]$ and $b \in [26.67, 27.02]$

$-38 + 27i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-40, -37]$ and $b \in [-28.56, -26.7]$

* $-38 - 27i$, which is the correct option.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

---

14. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{63 - 55i}{4 - 6i}$$

The solution is $11.19 + 3.04i$, which is option D.

A. $a \in [14.5, 16.5]$ and $b \in [8.5, 10]$

$15.75 + 9.17i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [-2, -1]$ and $b \in [-13.5, -11]$

$-1.50 - 11.50i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [10, 11.5]$ and $b \in [157, 158.5]$

$11.19 + 158.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [10, 11.5]$ and $b \in [1.5, 4.5]$

* $11.19 + 3.04i$, which is the correct option.

E. $a \in [581.5, 582.5]$ and $b \in [1.5, 4.5]$

$582.00 + 3.04i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

---

15. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-27 - 11i}{5 + 8i}$$

The solution is $-2.51 + 1.81i$, which is option B.

A. $a \in [-6, -5]$ and $b \in [-2, 0]$

$-5.40 - 1.38i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [-3, -1]$ and $b \in [0, 2.5]$

* $-2.51 + 1.81i$, which is the correct option.

C. $a \in [-1.5, 0]$ and $b \in [-4, -2]$

$-0.53 - 3.04i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [-224, -222]$ and $b \in [0, 2.5]$

$-223.00 + 1.81i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [-3, -1]$ and $b \in [160, 161.5]$

$-2.51 + 161.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

---

16. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{\sqrt{119}}{9} + \sqrt{-6}i$$

The solution is Irrational, which is option E.

A. Nonreal Complex

This is a Complex number ($a + bi$) that is not Real (has i as part of the number).

B. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

C. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

D. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

E. Irrational

* This is the correct option!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

---

17. Simplify the expression below and choose the interval the simplification is contained within.

$$13 - 17 \div 14 * 19 - (7 * 12)$$

The solution is -94.071, which is option D.

A. $[-205.86, -201.86]$

-204.857, which corresponds to not distributing a negative correctly.

B. $[-76.06, -68.06]$

-71.064, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[94.94, 98.94]$

96.936, which corresponds to not distributing addition and subtraction correctly.

D. $[-100.07, -90.07]$

* -94.071, which is the correct option.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

---

18. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{15}{0}}$$

The solution is Not a Real number, which is option E.

A. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

B. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

C. Irrational

These cannot be written as a fraction of Integers.

D. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

E. Not a Real number

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $\sqrt{\frac{15}{0}}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

---

19. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-2730}{14}} + \sqrt{0}i$$

The solution is Pure Imaginary, which is option B.

A. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

B. Pure Imaginary

* This is the correct option!

C. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

D. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

E. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

---

20. Simplify the expression below and choose the interval the simplification is contained within.

$$12 - 7^2 + 4 \div 10 * 16 \div 2$$

The solution is -33.800, which is option D.

A. $[55.01, 63.01]$

61.013, which corresponds to two Order of Operations errors.

B. $[-38.99, -33.99]$

-36.987, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[63.2, 68.2]$

64.200, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

D. $[-35.8, -29.8]$

* -33.800, this is the correct option

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

---

21. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(2 - 6i)(-8 + 10i)$$

The solution is $44 + 68i$, which is option C.

A. $a \in [-80, -70]$ and $b \in [25, 31]$

$-76 + 28i$, which corresponds to adding a minus sign in the second term.

B. $a \in [36, 45]$ and $b \in [-70, -64]$

$44 - 68i$, which corresponds to adding a minus sign in both terms.

C. $a \in [36, 45]$ and $b \in [68, 73]$

* $44 + 68i$, which is the correct option.

D. $a \in [-16, -12]$ and $b \in [-65, -58]$

$-16 - 60i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

E. $a \in [-80, -70]$ and $b \in [-28, -23]$

$-76 - 28i$, which corresponds to adding a minus sign in the first term.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

---

22. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{3969}{49}}$$

The solution is Integer, which is option C.

A. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

B. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

C. Integer

* This is the correct option!

D. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

E. Irrational

These cannot be written as a fraction of Integers.

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -63.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

---

23. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-5 + 7i)(6 - 8i)$$

The solution is $26 + 82i$, which is option C.

A. $a \in [-91, -85]$ and $b \in [-3, -1]$

$-86 - 2i$, which corresponds to adding a minus sign in the first term.

B. $a \in [-38, -26]$ and $b \in [-59, -54]$

$-30 - 56i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

C. $a \in [26, 29]$ and $b \in [79, 86]$

* $26 + 82i$, which is the correct option.

D. $a \in [-91, -85]$ and $b \in [2, 5]$

$-86 + 2i$, which corresponds to adding a minus sign in the second term.

E. $a \in [26, 29]$ and $b \in [-89, -79]$

$26 - 82i$, which corresponds to adding a minus sign in both terms.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

---

24. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-27 + 77i}{8 + 5i}$$

The solution is $1.90 + 8.44i$, which is option B.

A. $a \in [-5, -3]$ and $b \in [15, 16.5]$

$-3.38 + 15.40i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [1, 2.5]$ and $b \in [6, 9.5]$

* $1.90 + 8.44i$, which is the correct option.

C. $a \in [1, 2.5]$ and $b \in [750.5, 751.5]$

$1.90 + 751.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [-7, -6.5]$ and $b \in [4, 6.5]$

$-6.75 + 5.40i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [168.5, 170]$ and $b \in [6, 9.5]$

$169.00 + 8.44i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

---

25. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{72 + 55i}{4 + i}$$

The solution is $20.18 + 8.71i$, which is option B.

A. $a \in [342.5, 344]$ and $b \in [8, 10.5]$

$343.00 + 8.71i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [20, 21.5]$ and $b \in [8, 10.5]$

* $20.18 + 8.71i$, which is the correct option.

C. $a \in [20, 21.5]$ and $b \in [147.5, 149]$

$20.18 + 148.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [13, 14.5]$ and $b \in [15.5, 18]$

$13.71 + 17.18i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [17, 18.5]$ and $b \in [54.5, 56]$

$18.00 + 55.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

---

26. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{81}{0}} + \sqrt{90}i$$

The solution is Not a Complex Number, which is option E.

A. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

B. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

C. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

D. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

E. Not a Complex Number

* This is the correct option!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

---

27. Simplify the expression below and choose the interval the simplification is contained within.

$$8 - 10 \div 20 * 13 - (6 * 7)$$

The solution is -40.500, which is option C.

A. $[-31.9, -28.9]$

-31.500, which corresponds to not distributing a negative correctly.

B. $[47, 50.8]$

49.962, which corresponds to not distributing addition and subtraction correctly.

C. $[-42.5, -38.3]$

* -40.500, which is the correct option.

D. $[-38.4, -32.8]$

-34.038, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

---

28. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{78400}{400}}$$

The solution is Integer, which is option A.

A. Integer

* This is the correct option!

B. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

C. Irrational

These cannot be written as a fraction of Integers.

D. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

E. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -280.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

---

29. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{0}{361}} + \sqrt{5}i$$

The solution is Pure Imaginary, which is option D.

A. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

B. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

C. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

D. Pure Imaginary

* This is the correct option!

E. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

---

30. Simplify the expression below and choose the interval the simplification is contained within.

$$4 - 6 \div 1 * 16 - (8 * 11)$$

The solution is -180.000, which is option A.

A. $[-181, -178]$

* -180.000, which is the correct option.

B. $[-1101, -1097]$

-1100.000, which corresponds to not distributing a negative correctly.

C. $[87.62, 99.62]$

91.625, which corresponds to not distributing addition and subtraction correctly.

D. $[-86.38, -83.38]$

-84.375, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.